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EXAMINER	
SHAH, PARAS D	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/780,177	WU ET AL.	
	Examiner	Art Unit	
	PARAS SHAH	2626	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 March 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6,9,10 and 13-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1-6,9,10 and 13-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 February 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This communication is in response to the Amendments and Arguments filed on 03/27/2009. Claims 1-6, 9, 10, 13-24 remain pending and have been examined. The Applicants' amendment and remarks have been carefully considered, but they do not place the claims in condition for allowance.

2. All previous objections and rejections directed to the Applicant's disclosure and claims not discussed in this Office Action have been withdrawn by the Examiner.

Continued Examination Under 37 CFR 1.114

3. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 03/27/2009 has been entered.

Response to Amendment and Arguments

4. It should be noted that the Examiner of record for this case has changed from Samuel Graham to Paras Shah.

Drawings

5. The drawings are objected to because in Figure 3 and Figure 4, elements 326 and 422 have misspelled "Weiner filter" and should be "Wiener filter". Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

6. The disclosure is objected to because of the following informalities: The Specification has misspelled "Weiner Filter" and should be changed to "Wiener Filter" where such corrections be applied throughout the Specification.

Appropriate correction is required.

Response to Amendment and Arguments

7. Applicant's arguments (pages 7 and 8) filed on 03/27/2009 with regard to claims 1-6, 9, 10, 13-24 have been fully considered but they are moot in view of new grounds for rejection.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

9. Claim 24 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. ". Further, no description as to what this residue error is and is not adequately described in the specification in order for a reasonable interpretation to be formed. The closest sections in the specification that describe such feature is in paragraphs [0060] and [0050]. However, there is no description as to what the error is a residual of and how it classifies as a residue.

10. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

11. Claim 24 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is unclear from the claim and the Applicant's published Specification of what is meant by "covariance of a residue error". Further, no description as to what this residue error is and is not adequately described in the specification in order for a reasonable interpretation to be formed. The closest sections in the specification that describe such feature is in paragraphs [0060], and [0050]. However, there is no description as to what the error is a residual of and how it classifies as a residue. For the purposes of compact prosecution such term was interpreted to be a covariance of a noise estimate.

Claim Rejections - 35 USC § 102

12. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

13. Claim 24 is rejected under 35 U.S.C. 102(a) as being anticipated by Kim et al. ("Feature compensation Technique for Robust Speech Recognition in Noisy Environments").

As to claim 24, teaches a method of identifying a clean speech signal from a noisy speech signal, the method comprising:

receiving an observation vector representing a segment of a noisy speech signal (see page 359, sect. 4, Experimental Results, 1st paragraph, where a noisy speech signal is created);

determining a covariance of a residue error without using stereo training data (see page 358, left column, paragraph under equation 4, covariance of the noise log and see equation 4, where n_t is determined) ;

estimating a clean speech value and a noise value based on the observation vector wherein estimating a clean speech value and a noise value comprises using a parameter that describes the covariance of a residue error (see page 358, equation 5, and paragraph above equation 5, where the noise parameters are estimated and the clean speech signal is estimated based on the covariance);

using the clean speech value and the noise value to set a gain for a filter (see page 358, right column, equation 8 and 9, where the SNRs are used to calculate the gain).

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-6, 9, 10, 13-18, 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over ***Acero*** ("Environmental Robustness in Automatic Speech Recognition" IEEE 1990) in view of ***Pastor*** (6,445,801).

As to claim 1, ***Acero*** discloses a method of identifying a clean speech signal from a noisy speech signal, the method comprising:

receiving an observation vector representing a segment of a noisy speech signal (page 849-850, section 2, *a speech signal with uncorrelated additive noise*);

estimating a clean speech value and a noise value based on the observation vector (page 850, section 4, *an ML estimator is used to determine the noise vectors, then an MMSE estimator is used to estimate the uncorrupted (clean speech)vector*).

However, ***Acero*** does not disclose using the clean speech value and the noise value to set a gain for a filter, and applying the observation vector to the filter to produce a filtered clean speech vector representing a segment of a clean speech signal.

Pastor discloses a system that using the clean speech value and the noise value to set a gain for a filter (see col. 3, lines 15-24, especially equation and see Figure 1, steps 2 and 3 where the noise and signal energy is determined and the speech energy is the signal subtracted by the noise) and see wherein setting a gain for a filter comprises defining the gain as a ratio with denominator

of the ratio being the sum of the clean speech value and the noise value and a numerator of the ratio that is a function of the clean speech value and the noise value (see col. 3, lines 15-24, especially equation of Wiener Filter) (e.g. It is inherent from the equation in Pastor that a simple substitution for the power spectral density of the noisy signal with the summing of the speech and noise spectral density is equivalent and using this substitution for establishing a common denominator. The result yields the sum of the speech and noise in the denominator and the numerator being a function of speech and noise. The clean speech estimate is simply the subtraction of the noisy speech signal by the estimate of the noise.); and

applying the observation vector to the filter to produce a filtered clean speech vector representing a segment of a clean speech signal (see Figure 1, step 5, where the signal is reconstructed from the wiener filtering and see col. 4, lines 59-col. 5, lines 3)

All of the claimed elements are disclosed in ***Acero*** and ***Pastor,*** and both techniques are used during speech normalization prior to speech recognition. The only difference is the combination of these known elements, i.e. using the method disclosed in ***Acero*** to estimate the clean and noise speech values, which are then used in the filter system disclosed in ***Pastor***.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use the clean speech value and the noise value to set a gain for a

filter, and apply the observation vector to the filter to produce a filtered clean speech vector representing a segment of a clean speech signal in ***Acero***, since one of ordinary has good reason to pursue the options within his or her technical grasp in order to achieve the predictable result of developing a noise suppression system that is robust changing input, as indicated in both ***Acero*** (Abstract) and ***Pastor*** (see col. 2, lines 49-55).

As to claim 2, ***Acero*** in view of ***Pastor*** disclose the method of claim 1, and ***Acero*** further discloses wherein estimating a clean speech value and a noise value comprises using parameters that describe a distribution of noise values (page 850, section 4.2, *ML estimation of noise*).

As to claim 3, ***Acero*** in view of ***Pastor*** disclose the method of claim 2, and ***Acero*** further discloses comprising determining the parameters of the distribution of noise values (page 850, section 4.2, *ML estimation of noise*).

As to claim 4, ***Acero*** in view of ***Pastor*** disclose the method of claim 3, and ***Acero*** further discloses wherein determining the parameters of the distribution of noise values comprises determining the parameters based on multiple segments of the noisy speech signal (page 850, section 4.2, *ML estimation of noise*).

As to claim 5, ***Acero*** in view of ***Pastor*** disclose the method of claim 3, and ***Acero*** further discloses wherein determining the parameters of the distribution of noise values comprises determining a mean of the distribution of noise values using an iteration (page 850, section 4.2, *ML estimation of noise*).

As to claim 6, ***Acero*** discloses the method of claim 5, and ***Acero*** further discloses wherein determining a mean of the distribution of noise values using an iteration comprises at each iteration updating the mean by adding a value to the value of the mean in a past iteration, the value added to the mean not being computed based on a product formed between a covariance of the noise distribution and a difference between the observation vector and another value (page 850, section 4.2, *the EM algorithm is used to obtain ML solutions*).

As to claim 9, ***Acero*** in view of ***Pastor*** disclose the method of claim 7, however ***Acero*** does not disclose wherein defining the gain as a ratio comprises defining the ratio such that it is guaranteed to be positive if the clean speech value and the noise value are positive.

Pastor discloses wherein defining the gain as a ratio comprises defining the ratio such that it is guaranteed to be positive if the clean speech value and the noise value are positive (see col. 7, lines 38-56, and see col. 3, lines 15-24, where the term alpha is a*max is an overestimation coefficient used).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to define the ratio such that it is guaranteed to be positive if the clean speech value and the noise value are positive in ***Acero***, since one of ordinary skill in the art has good reason to pursue the options within his or her technical grasp in order to achieve the predictable result of designing a

robust noise suppression filter for removing noise from useful signals (see Pastor col. 2, lines 50-53).

As to claim 10, ***Acero*** in view of ***Pastor*** disclose the method of claim 1, and ***Acero*** further discloses wherein the observation vector has been formed without applying a frequency-based transform (Abstract, *the technique uses cepstral vectors*).

As to claim 13, ***Acero*** discloses a computer-readable medium having computer-executable instructions for performing steps comprising:

obtaining an estimate of a clean speech value and an estimate of a noise value derived from a noisy speech signal (page 850, section 4, *an ML estimator is used to determine the noise vectors, then an MMSE estimator is used to estimate the uncorrupted (clean speech)vector*);

However, ***Acero*** does not disclose setting a numerator of a filter gain ratio as a function of the clean speech value and the noise value, setting a denominator of the filter gain ratio as a function of the clean speech value and the noise value, and using the filter gain ratio in a filter that is applied to the noisy speech signal.

Pastor discloses a numerator of a filter gain ratio as a function of the clean speech value and the noise value (see col. 3, lines 15-24, especially

equation of Wiener Filter) (e.g. Manipulation of the equation by substituting ($\gamma_s + \gamma_x$) for γ_u and making a common denominator yields the numerator being a function of noise and speech);

setting a denominator of the filter gain ratio as the sum of the clean speech value and the noise value (see col. 3, lines 15-24, especially equation of Wiener Filter, Manipulation of the equation by substituting ($\gamma_s + \gamma_x$) for γ_u in the denominator yields the sum as claimed (see col. 6, lines 20, equation 6, where the equivalence is shown) (e.g. It is inherent from the equation in Pastor that a simple substitution for the power spectral density of the noisy signal with the summing of the speech and noise spectral density is equivalent and using this substitution for establishing a common denominator. The result yields the sum of the speech and noise in the denominator and the numerator being a function of speech and noise. The clean speech estimate is simply the subtraction of the noisy speech signal by the estimate of the noise.).

using the filter gain ratio in a filter that is applied to the noisy speech signal (see Figure 1, step 5, where the signal is reconstructed from the wiener filtering and see col. 4, lines 59-col. 5, lines 3).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to set a numerator of a filter gain ratio as a function of the clean speech value and the noise value, set a denominator of the filter gain ratio as a function of the clean speech value and the noise value, and use the

filter gain ratio in a filter that is applied to the noisy speech signal in ***Acero***, since one of ordinary skill in the art has good reason to pursue the options within his or her technical grasp in order to achieve the predictable result of designing a robust noise suppression filter that is robust changing input, as indicated in both ***Acero*** (Abstract) and ***Pastor*** (see col. 2, lines 49-55).

As to claim 14, this claim recites limitations similar to those recited in claim 2, and is therefore rejected for similar reasons.

As to claim 15, this claim recites limitations similar to those recited in claim 3, and is therefore rejected for similar reasons.

As to claim 16, this claim recites limitations similar to those recited in claim 4, and is therefore rejected for similar reasons.

As to claim 17, ***Acero*** in view of ***Pastor*** disclose the computer-readable storage medium of claim 16, and ***Acero*** further discloses wherein determining the parameter comprises determining a mean iteratively, wherein each iteration utilizes an update equation that is formed by maximizing the joint probability of a sequence of observation vectors and a sequence of mixture component indices (page 850, section 4.2, *ML estimation of noise*).

As to claim 18, ***Acero*** in view of ***Pastor*** disclose the computer-readable storage medium of claim 13, and ***Acero*** further discloses wherein obtaining an estimate of a clean speech value and an estimate of a noise value comprises estimating a cepstral clean speech value and a cepstral noise value in a cepstral domain and converting the

cepstral clean speech value and the cepstral noise value into the spectral domain to produce a spectral domain clean speech value and a spectral domain noise value (Abstract and Figure 1, *speech and noise vectors are cepstral vector, and Figure 1 displays the speech and noise spectrum from the stereo database. Therefore it is inherent the cepstral values are converted to spectrum values*).

As to claim 21, ***Acero*** in view of ***Pastor*** disclose the computer-readable storage medium of claim 13, and ***Acero*** further discloses wherein obtaining an estimate of the noise value comprises utilizing a parameter that describes a distribution for a residue error (page 850, section 4.2, *ML estimation of noise vector* n_k).

As to claim 22, ***Acero*** in view of ***Pastor*** disclose the computer-readable storage medium of claim 13, and ***Acero*** further comprising determining the parameter that describes the distribution for the residue error without using clean speech training data (see sect. 4.2, Ml estimation of noise, where an observation vector, z, and equalization vectors n and q is used for an utterance and the uncorrupted vector x is being determined.).

As to claim 23, this claim recites limitations similar to those recited in claim 9, and is therefore rejected for similar reasons.

15. Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Acero** in view of **Pastor** as applied to claim 18 above, and further in view of **Arslan** (US 5,706,395).

As to claim 19, ***Acero*** in view of ***Pastor*** disclose the computer-readable storage medium of claim 18.

However ***Acero*** in view of Arslan does not disclose wherein obtaining an estimate of a clean speech value and an estimate of a noise value further comprises smoothing the spectral domain clean speech value and the spectral domain noise value across frequencies.

Arslan discloses smoothing prior to filtering by the wiener filter (column 8 lines 14-40, W(ω) , smoothing window).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to smooth the spectral domain clean speech value and the spectral domain noise value across frequencies in ***Acero*** in view of ***Pastor***, since it reduces noise fluctuations in the filtered speech signal, as indicated in ***Arslan*** (column 8 lines 25-28).

As to claim 20, ***Acero*** in view of ***Pastor*** disclose the computer-readable storage medium of claim 18.

However ***Acero*** in view of **Pastor** does not disclose wherein obtaining an estimate of a clean speech value and an estimate of a noise value further comprises smoothing the spectral domain clean speech value and the spectral domain noise value across time.

Arslan discloses smoothing prior to filtering by the wiener filter (column 8 lines 14-40, rectangular window with corresponding window in frequency domain, $W(\omega)$).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to smooth the spectral domain clean speech value and the spectral domain noise value across frequencies in ***Acero*** in view of ***Pastor*** , since it reduces noise fluctuations in the filtered speech signal, as indicated in ***Arslan*** (column 8 lines 25-28).

Conclusion

16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Chabries (Us 4,658,426) and Eatwell (US 5,768,473) is cited to disclose an adaptive speech filter. Linhard (US 5,400,409), Anderson (Us 6,351,731) Marash et al. (US 6,363,345), Lockwood (US 6,477,489), Oh et al. (US 7,177,805), Wu (US 7,133,828), Walker (Us 2003/0033139) is cited to disclose cancellation of noise using a filter. Johnson (US 6,415,253) is cited to disclose enhancing noise corrupted speech. Accardi et al. (US 2002/0002455) is cited to disclose estimation of gains in a hybrid speech enhancement system. Yang (US 2004/0186710) is cited to disclose a filter for noise reduction.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SAMUEL GRAHAM whose telephone number is

(571)270-16505360. The examiner can normally be reached on MON.-THURS. 7:00a.m.-4:00p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Hudspeth can be reached on (571)272-78437603. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/David R Hudspeth/
Supervisory Patent Examiner, Art Unit 2626

/P. S./
Examiner, Art Unit 2626

06/03/2009